SECTION F

STUDENT IDENTIFICATION NUMBER

Physics 30X
1969

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EXAMINATIONS BOARD

DEPARTMENTAL EXAMINATIONS, 1969

PHYSICS 30X

Time — 2 hours.

Total Possible Mark — 128.

PLEASE REFER TO PAGE 2 FOR INTRUCTION RE COMPLETION OF ANSWER SHEET.

To ensure accuracy in the handling of your examination booklet, Section E below, and Section F above, MUST BE COMPLETED in the following manner:

SECTION E — *Step (1) Carefully check label.* Notify the presiding examiner if the name on the label does not correspond to your name.

Step (2) Place label into the dotted box.

Step (3) Indicate your name, mailing address and birth date whether or not you have a label.

SECTION F — From the label, write your student number in the area designated. IF NO LABEL HAS BEEN PROVIDED, omit Section F.

Machine Score
Book Score
TOTAL

(For the use of the Department only)

PLACE RED SEAL HERE

DO NOT FOLD EITHER THE ANSWER SHEET OR THE TEST BOOKLET.

Your presiding examiner will collect the answer sheet and booklet separately for transmission to the Department.

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Place label in dotted box

SECTION E

The following information must be given:

Name ....
Surname Christian Names

Mailing Address ....
City, Town, Village

Birth Date ....
Day Month Year

Questions 1 to 42 are multiple choice questions and are to be recorded on the separate ANSWER SHEET provided. These questions are valued at 2 marks each.

Your score in this section is the number of correct answers you give. If a question seems to be too difficult, make the most careful guess you can, rather than waste time puzzling over it.

Questions 43 - 51 must be done in this booklet.

Finished work in this booklet must be done in pencil or blue or black ink (pen or ballpoint).

NOTE — Mathematical tables will be supplied by the Presiding Examiner.
Slide rules may be used.

Use the following constants where they are required:

$g = 10$ m/sec^2
1 calorie = 4.2 joules
1 coulomb = 6.24×10^{18} elem. ch.
1 volt = 1.6×10^{-19} joules/elem. ch.
mass of electron = 9.1×10^{-31} kg

To ensure accuracy in the handling of your examination papers, the following sections on your answer sheet MUST BE COMPLETED.

SECTION A — Supply information as requested.

SECTION B — *Step (1)* *Carefully check label.* Notify the presiding examiner if the name on the label does not correspond to your name.

Step (2) Place label into the dotted box.

Step (3) Indicate your name, mailing address and birth date whether or not you have a label.

SECTION C — Supply information as requested.

SECTION D — *Step (1)* From the label, write your student number into the column of blank boxes in Section D. Begin by placing the left-most digit into the top box.

Step (2) For the digit you have placed into each box, blacken the appropriate guide line containing this digit.

IF NO LABEL HAS BEEN PROVIDED, omit Section D.

Questions 1 - 42 are to be machine scored. You are to record your answer on the separate answer sheet which is provided. Each question has four suggested answers. Select the best answer and record it on the separate ANSWER SHEET, as shown in the example below.

EXAMPLE	ANSWERS	ANSWER SHEET
A body moves at the rate of 4.0 m/sec. How far will it travel in 10 sec?	A. 20 m B. 40 m C. 60 m D. 80 m	A ▭ B ▬ C ▭ D ▭ E ▭ DISREGARD COLUMN "E" ON THE ANSWER SHEET

You are to use an ORDINARY HB PENCIL to mark your answers on the ANSWER SHEET. Make certain your answer marks are heavy and black and that they do not extend beyond the guide lines. If you change your mind about an answer, be sure to erase your first mark completely. There should be only one answer marked for each question. Be sure there are no stray pencil marks on your answer sheet.

1. Three measurements of length are recorded as 4.0 cm, 2.29 cm, and 6.882 cm. The sum of these measures is properly expressed as

1. [✓ A. 13]
B. 13.1
C. 13.17
D. 13.2

2. If the volume of cube A is 8 times greater than the volume of cube B then the ratio of the surface area of A to the surface area of B is

2. A. 2 : 1
B. 4 : 1
C. $\sqrt{8}$: 1
D. 16 : 1

FOR ROUGH WORK
(No marks given for work in this space)

$V = x^3$

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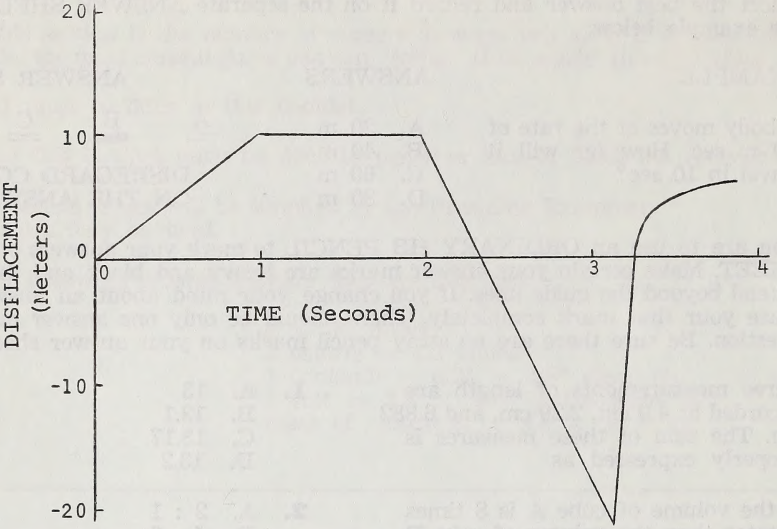
Questions 3 - 5 refer to the following graph and information.



The graph represents the displacement from a fixed point, as a function of time, of an object moving in a straight line on a horizontal surface.

3. The object has a constant speed of about 10 m/sec during the

[✓ A.] 1st second
B. 2nd second
C. 3rd second
D. 4th second

4. The object is at rest during the

A. 1st second
[✓ B.] 2nd second
C. 3rd second
D. 4th second

5. The maximum speed of the object occurs during the

A. 1st second
B. 2nd second
C. 3rd second
[✓ D.] 4th second

FOR ROUGH WORK

(No marks given for work in this space)

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Questions 6 - 8 refer to the following information.

An airplane is to fly from city A to city B. City B is 300 miles due north of city A. The airspeed of the plane is 200 mi/hr and there is a wind blowing from the west at 50.0 mi/hr.

6. In order to travel in a straight line path from A to B the aircraft should be headed

6.
- A. between north and 30° west of north
- B. between north and 30° east of north
- [✓ C.] more than 30° west of north
- D. more than 30° east of north

7. The ground speed of the aircraft during the straight line journey from A to B is approximately

7.
- A. 205 mi/hr
- B. 200 mi/hr
- C. 195 mi/hr
- D. 150 mi/hr

8. If another aircraft, with the same airspeed as the first, left city B to fly straight to city A at the same time, then these planes would meet

8.
- A. half way between A and B
- B. nearer A than B
- C. nearer B than A
- D. at some point east of line AB

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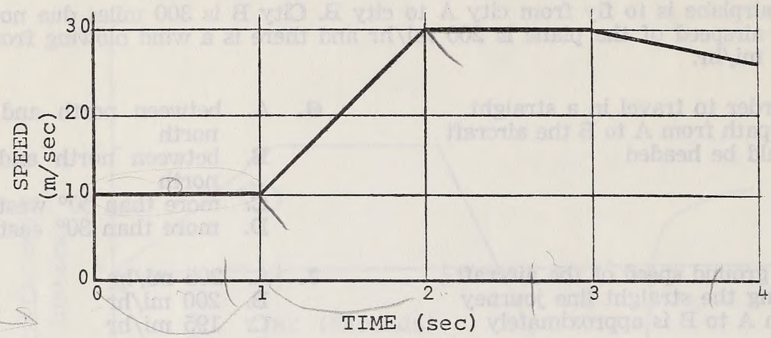
9. By applying a certain force a crate can be accelerated across a floor where the frictional resistance is constant. If the applied force is doubled the acceleration will

9.
- A. increase
- B. double
- C. remain constant
- D. quadruple

FOR ROUGH WORK

(No marks given for work in this space)

Questions 10 - 12 refer to the following graph and information.



friction

The graph represents the speed of a body, as a function of time, as it moves in a straight line along a horizontal surface against a constant frictional force.

10. The maximum force is being applied to the body during the

10. A. 1st second
[✓ B.] 2nd second
C. 3rd second
D. 4th second

$F = m\frac{v}{t}$

11. The minimum force is being applied to the object during the

11. A. 1st second
B. 2nd second
C. 3rd second
D. 4th second

12. If the surface had been frictionless the maximum force, as indicated by the graph, would have occurred during the

12. A. 1st second
B. 2nd second
C. 3rd second
D. 4th second

FOR ROUGH WORK

(No marks given for work in this space)

13. If the only force applied to a body is constant in magnitude and perpendicular to the motion of a body, then the body will move in

13.
A. a decreasing spiral
B. an increasing spiral
C. a circle with constant speed
D. a circle with constant acceleration

14. A body is sliding down a frictionless inclined plane with an acceleration of 5.0 m/sec^2. The angle of the plane to the horizontal is

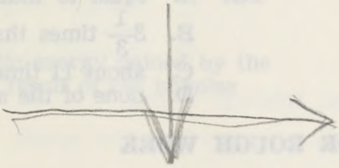
14.
A. 45°
B. 30°
C. 60°
D. 22.5°

15. If the uniform speed of a body moving in a circle is doubled, then the magnitude of its acceleration

15.
A. remains unchanged
B. is doubled
C. is halved
D. is quadrupled

FOR ROUGH WORK

(No marks given for work in this space)



Questions 16 - 18 relate to the following information.

Suppose two earth satellites, A, which is 1000 kg in mass, and B, which is 300 kg in mass are travelling in the same orbit around the earth at a distance of about 200 miles above the earth's surface.

16. The gravitational force on satellite A will be

16. A. zero
B. equal to that on satellite B
C. a little less than 10^4 newtons
D. a little more than 10^4 newtons

17. The speed of satellite A is

17. A. the same as that of satellite B
B. $\frac{3}{10}$ times that of satellite B
C. $3\frac{1}{3}$ times that of satellite B
D. $\frac{9}{100}$ times that of satellite B

18. The centripetal force on satellite A is

$F = \frac{mv^2}{r}$

18. A. equal to that on satellite B
B. $3\frac{1}{3}$ times that on satellite B
C. about 11 times that on satellite B
D. none of the above

FOR ROUGH WORK

(No marks given for work in this space)

Questions 19 - 22 relate to the following information.

A 10 kg dog is riding on a 5.0 kg sled as it moves at a constant speed of 1.2 m/sec. Then the dog suddenly jumps from the sled and is observed to have a horizontal velocity of zero with respect to the earth immediately after he leaves the sled.

19. The momentum of the sled alone before the dog jumps is

19.
A. 60 kg m/sec
B. 36 kg m/sec
C. 6.0 newton-sec
D. 18 newton-sec

20. The momentum of the sled after the dog jumps is

20.
A. 6.0 newton-sec
B. 18 kg m/sec
C. 12 kg m/sec
D. 12 newton-sec

21. The impulse given to the sled as a result of the jump

21.
A. cannot be found without knowing the amount of force acting
B. cannot be found without knowing the time during which the force acts
C. is 12 newton-sec
D. is 18 newton-sec

22. The kinetic energy gained by the sled as a result of the impulse above

22.
A. is equal to that lost by the dog
B. is greater than that lost by the dog
C. is less than that lost by the dog
D. cannot be determined from the information given

FOR ROUGH WORK

(No marks given for work in this space)

Questions 23 and 24 relate to the following information.

A 2.0 newton force acts on a 1.0 kg mass for 3.0 sec in the direction of motion of the mass which started from rest.

23. The gain in kinetic energy of the mass due to the action of the force is

E=Fd
mad

23.
A. 2.0 joules
B. 4.0 joules
C. 6.0 joules
D. 18 joules

24. If the mass had been greater the gain in kinetic energy

24.
A. would have been less
B. would have been the same
C. would have been greater
D. could have been any of these depending on its actual size

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25. When the brakes are applied to a car rolling down a hill and bring it to a stop its kinetic energy is

25.
A. reduced without changing to any other form
B. mostly changed to kinetic energy of the earth
[✓ C.] changed to gravitational potential energy
D. changed to heat

FOR ROUGH WORK

(No marks given for work in this space)

Questions 26 - 28 relate to the following information.

A student fastened 0.50 kg mass of brass to the end of a spring which had a linear restoring force. After the mass assumed a rest position he pulled it down a further 5.0 cm. On release the mass executes simple harmonic motion.

26. During the oscillation the kinetic energy of the 0.50 kg mass is at its maximum when the

26. A. gravitational potential of the brass weight is at its minimum
B. energy stored in the spring is at its minimum
C. sum of gravitational potential of the brass weight and the energy stored in the spring is a minimum
D. 0.50 kg mass is at its lowest point

27. The loss of gravitational potential by the 0.50 kg brass weight as it moves from its highest to its lowest position during the oscillation is

27. A. 0.25 joule
B. 1.0 joule
C. 0.05 joule
D. 0.50 joule

28. The energy stored in the spring is greatest

28. A. whenever the brass weight comes to rest momentarily
B. when the brass weight reaches the midpoint of its vertical motion
C. when the brass weight reaches its lowest point
D. when the brass weight reaches its highest point

FOR ROUGH WORK

(No marks given for work in this space)

Questions 29 - 31 relate to the following information.

A liter of oxygen gas was enclosed in a rigid container at a temperature of 30° C. and a pressure of 1.0 atmosphere. Its temperature was then raised to 60° C.

29. With this change in temperature, the kinetic energy of the gas molecules is

29. A. increased by about 10%
B. increased by about 20%
C. doubled
D. unchanged

30. With this change in temperature the total momentum of all the gas molecules is likely to be

30. A. increased by about 10%
B. increased by about 20%
C. doubled
D. unchanged

31. With this change in temperature the average speed of the molecules will

31. A. double
B. increase by about 5%
C. increase by about 10%
D. increase by about 20%

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32. A stream of electrons passes horizontally between two parallel horizontal plates, the upper of which is charged positively and the lower of which is negative. The electrons will be

32. A. unaffected
B. deflected downwards
C. deflected upwards
D. deflected in a horizontal plane

FOR ROUGH WORK

(No marks given for work in this space)

33. Three metal blocks A, B and C in contact and in a line are resting on an insulating material. Two strongly charged positive objects are brought from opposite directions, close to, but not touching A and C. The middle block B is poked out with an uncharged insulating rod. Finally the charged objects are removed. Then	**33.** A. A and C are negative, B is positive B. A and C are negative, B is neutral C. A and C are positive, B is negative D. A and C are positive, B is neutral
34. Two equally charged spheres repel one another with a force of 8.0×10^{-3} newtons. If the distance between them is halved and the charge on one of them is doubled, the force is	**34.** A. 64×10^{-3} newtons B. 32×10^{-3} newtons C. 8.0×10^{-3} newtons D. 1.3×10^{-2} newtons
35. In the Millikan oil drop experiment, when the voltage is applied, generally one will see oil drops,	**35.** A. all moving with equal velocity B. all moving up with different velocities C. some moving up and some down but with equal speeds D. some moving up and some down with different speeds

FOR ROUGH WORK

(No marks given for work in this space)

36. A, B and C are three identical charges placed at the corners of an equilateral triangle. The force on C due to A is 2 newtons. Then the force on C due to A and B is

36. A. $\sqrt{2}$ newtons
B. 2 newtons
C. $2\sqrt{3}$ newtons
D. $\sqrt{3}$ newtons

37. In a partially evacuated tube, the filament emits 3.0×10^{16} electrons/sec which move to the anode. At the same time 0.6×10^{16} singly charged (positive) atoms move in the opposite direction. The total current is

37. A. 2.4×16^{16} elem. ch./sec
B. 3.6×10^{16} elem. ch./sec
C. 3.0×10^{16} elem. ch./sec
D. 0.6×10^{16} elem. ch./sec

38. Wire A has a resistance of R ohms. Another wire B of the same material is twice as long and has one-half the diameter of A. The resistance of B is

38. A. 4 R ohms
B. 8 R ohms
C. 0.5 R ohms
D. 2 R ohms

FOR ROUGH WORK

(No marks given for work in this space)

39. Two long parallel wires each carrying 5 amperes in the same direction are situated near each other and are free to move. The wires will

39. A. move together
B. move apart
C. be unaffected
D. tend to move in the direction of the current

40. A wire 10 cm long, carrying a current, is placed in a magnetic field. The wire is parallel to the lines of force. If the length of wire is doubled and the current also doubled, while the direction of the wire remains constant, then the force on the wire due to the field is

40. A. increased 4 times
B. halved
C. unchanged
D. none of these

41. A wire 5 cm long extends horizontally in an east-west direction through a vertical magnetic field. It is moving north at a speed of 0.1 m/sec. If the strength of the field is 0.02 newtons/ampere-m, what is the E.M.F. between the ends of the wire?

41. A. 4×10^{-6} volt
B. 1×10^{-2} volt
C. 2×10^{-4} volt
D. 1×10^{-4} volt

42. A positively charged electroscope is completely enclosed by a metal screen. A positively charged rod is gradually brought near the outside of the metal screen. The electroscope leaves will

42. A. move further apart
B. move closer together
C. first collapse and then move further apart
D. remain unchanged

FOR ROUGH WORK

(No marks given for work in this space)

FOR ROUGH WORK

(No marks given for work in this space)

Values

In answering the following problems show your solutions in logical steps. When diagrams are drawn to scale, the scale used should be clearly indicated.

3 **43.** In travelling 2.0 km along a straight road a car increased its speed uniformly from 1.0 m/sec to 9.0 m/sec. What was the acceleration of the car in m/sec^2?

6 **44.** A 10 kg body initially at rest on a frictionless horizontal surface is acted upon simultaneously by three forces: 10 newtons due east, 6.0 newtons due north and 18 newtons due west. Calculate how far the body will have moved after the forces have been acting for 2.0 sec.

FOR ROUGH WORK

(No marks given for work in this space)

Values

4 **45.** A stone of mass 2.0 kg is attached to the end of a length of rope and whirled in a vertical circle of radius 2.5 m. What is the minimum speed that the stone must have at the highest point in order to maintain circular motion?

7 **46.** An 8.0 gm steel ball attains a speed of 1.0 m/sec as it rolls down a ramp. It then strikes a 3.0 gm glass ball which is at rest on a level surface. As a result of the collision the steel ball changes its direction by 17° and its speed is reduced to 0.80 m/sec. What is the speed and direction of the glass ball immediately after the collision?

[OVER]

FOR ROUGH WORK

(No marks given for work in this space)

Values

5 **47.** A 100 gm ball is observed to gain a velocity of 15 m/sec in falling from rest through a distance of 20 m. How many calories of heat are generated by air friction during the fall?

6 **48.** A charged sphere of mass 4.6×10^{-3} kg is hanging vertically on a 2.0 m string. Another charged body is brought near and it is observed that the sphere is pulled aside 2.0 cm from its original position. What is the magnitude of the electric force on the sphere?

[OVER]

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DEPARTMENTAL EXAMINATIONS GRADE
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FOR ROUGH WORK

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LB 3054 C2 D419 1969 phy.30X
Departmental examinations,
[grade 12] 1969. -

39780798 CURR HIST

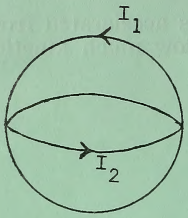
Values

4 **49.** A doubly charged ion in a uniform electric field is accelerated from rest by a force of 3.5×10^{-5} newtons over a distance of 1.0 cm. How much kinetic energy does the ion gain?

4 **50.** The electric field between two parallel plates is 1.0×10^{3} newtons/coulomb. If the plate separation is 0.20 cm, what is the potential difference between the plates?

Values

5 **51.**



Two circular wire loops, each with a radius of 0.50 m, are set at right angles to each other with a common center, as shown in the accompanying diagram. The vertical loop carries a current I_1 of $\sqrt{3.0}$ amperes and the horizontal loop a current I_2 , of 1.0 ampere. What angle does the resultant field at the center make with the vertical?

FOR ROUGH WORK

(No marks given for work in this space)